Nonpenetrating Abdominal Injuries

WILLIAM BROCK, *M.D.*, and GEORGE CUSICK, *M.D.*, Stockton

• **Nonpenetrating abdominal injuries are commonly seen in a general hospital. High speed traffic accidents are responsible for the majority of these injuries. The mortality rate is high. Deaths were from associated injuries, failure to recognize abdominal trauma, hemorrhage and from acute renal insufficiency. Careful observation of every severely injured person, vigorous treatment of hemorrhagic shock with whole blood, and prompt surgical intervention when indicated will improve the mortality figures.**

NONPENETRATING OR BLUNT INJURIES to abdominal organs present a constant problem in any hospital in which patients with traumatic injury are cared for. Such injuries are common in occurrence and the management of them is extremely difficult. In the past seven years the authors have observed 93 cases of this kind. Data on the site or nature of injury, surgical treatment and mortality follow:

Organ Injured or Nature of Injury	No. Cases	No. Cases Operated On	Deaths	Mortality Rate (Per Cent)
Spleen	30	29*	5	16
Kidney	23	2†	0	0
Urinary bladder	9	9	0	0
Liver	10	8	5	50
Stomach	1	1	0	0
Small bowel	7	7	1	14
Colon	5	5	1	20
Diaphragm	5	4	0	0
Pancreas	3	(All associated with other abdominal injuries) *		
Ruptured pregnant uterus	1	0	0	0
Hemoperitoneum	2	0	0	0

*One splenectomy performed at another hospital.
†Includes one ruptured renal neoplasm.

Most of these problems are owing to traffic accidents at high speed, and multiple injuries are common. Dealing with the abdominal injury is usually merely a part of the treatment of a patient who has been severely hurt in a collision. The association of one injury with multiple major injuries of other visceral and skeletal structures may obscure proper recognition and render the application of appropriate treatment more difficult. In the previously mentioned 93 cases there were, in addition to the abdominal injury, more than 150 fractures, simple or compound. Major intracranial or thoracic injuries were observed in approximately 20 per cent of the cases. Diagnosis was particularly difficult in patients who were comatose from cerebral trauma. Alcoholic indulgence, observed in a high proportion of cases, presented additional difficulties.

The overall mortality in the present series was 12.9 per cent. The site of injury and the cause of death were as follows:

Cause of Death	Organ Injured: Spleen	Liver	Small Bowel	Colon
Hemorrhage and multiple injuries	2	2	....	....
Renal failure	1	1	1	1
Aspiration of fluid	1	....	....	....
Multiple injuries	1	2	....	....

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Concomitant multiple injuries to the cranium, thorax and skeletal structures contributed significantly to fatality in three cases. Hemorrhage, either recognized or unrecognized, was directly responsible for four deaths. In three of these cases the bleeding was from severe liver lacerations (in one of which there was also bleeding from multiple intra-abdominal injuries) and in one from a severely lacerated spleen in a young child who was thought to have a cranial injury.

Renal insufficiency led to four deaths although associated factors played accessory roles. These fatalities followed long existing hemorrhagic shock either before arrival or after admission to the hospital. One death resulted from aspiration of blood on the operating table. An intratracheal tube had not been used.

Severe multiple extraabdominal or intraabdominal injuries were present in seven of the twelve patients who died.

The high mortality rate reflects in part the severity of the injuries. However, with more rapid evaluation of the situation of the individual cases and more vigorous treatment of the hemorrhagic shock, some of the deaths might be classified as preventable.

DIAGNOSIS

Successful treatment rests upon the establishment of a diagnosis or strong suspicion of hemorrhage or of contamination from hollow viscera. Accurate diagnosis depends in great part on the acuity of the individual examiner. Knowledge of the mode of injury, the symptoms and physical findings, and the laboratory and x-ray aids should lead to a proper diagnosis in most cases.

In many cases in the present series the diagnosis on admission from the emergency ward did not

indicate a strong suspicion of abdominal injury. The majority of the patients had serious associated injuries which focused the examiner's attention. In others the signs and symptoms of abdominal injury had not progressed to a point to be readily recognizable. This emphasizes the absolute necessity of careful and frequent reevaluation of each severely traumatized person. A changing clinical picture may be all important in reaching a final decision.

History of Injury

Visible signs of contusion to the abdominal parietes were not often present. History of a blow to a specific abdominal area was occasionally of value. The majority of patients gave few details; they had but vague memory of an automobile accident. Data on the kind of accident and the organs injured follow:

Type	Liver	Spleen	Kidney	Bladder	Gastro-intestinal Tract	Diaphragm
Vehicular..	7	22	16	9	7	5
Blows	3	2	6	0	5	0
Falls	0	4	1	0	1	0

In several cases no history of abdominal injury was obtained prior to operative intervention. Lack of information of this sort would seem to be more likely if the patient is a child or if he was under strong influence of alcohol at the time of injury. Another factor that may confuse diagnosis is that the injury may have sufficiently antedated the present complaint as to be disregarded.

Two illustrative cases follow:

CASE 1. A three-year-old child was admitted to the hospital because of distention and abdominal pain. Severe signs of peritonitis led to laparotomy. A large tear in the jejunum was found. Subsequent questioning revealed that there had been a blow to the abdomen.

CASE 2. A 36-year-old woman was admitted to the hospital because of the onset of severe sudden pain in the left upper quadrant of the abdomen. Similar pain of minor degree had occurred during the previous several weeks. Rapidly increasing anemia developed after 24 hours' observation and signs of peritonitis progressed. Upon laparotomy a secondary rupture of the spleen was observed. Subsequent questioning evoked that the causative injury had occurred four months previously.

Liver and Spleen

Because of the location of the liver and spleen under the protective barrier of the thoracic cage, thoracic trauma was associated with injury to the liver and spleen in 23 of the 40 cases of damage to those organs in the present series, as follows: Segmental rib fractures in 12 cases, hemopneumothorax in four cases, contusion of myocardium in two, and mediastinal hemorrhage, lacerated pericardium and hemopericardium in one case each. Hence, when severe thoracic injuries are present, possible injury to the solid upper abdominal viscera should be suspected. In addition, referred pain from above the diaphragm to the abdominal parietes may present confusing evidence.

Symptoms of upper abdominal pain, abdominal tenderness and spasm were consistently observed. The presence or absence of peristalsis was of little value. Shoulder pain was present in about 50 per cent of patients with splenic injuries. This sign may be elicited only on deep inspiration, or with the patient in the Trendelenburg position or with manual pressure in the left upper quadrant.

Signs of blood loss were consistently observed and were particularly significant in the absence of external bleeding or hemorrhage into soft tissues or the pleural cavities. The majority of the patients were in varying degrees of hemorrhagic shock when first observed. Pallor, tachycardia and lowered blood pressure were the most reliable indications of loss of blood.

Initial hemoglobin or hematocrit determinations, although of value, were of much less value in estimating loss of blood. A progressive decrease in hemoglobin or packed cell volume, or failure to respond or to be maintained on whole blood therapy was a more reliable indication of internal bleeding. Leukocytosis was so consistently observed it was considered to be good confirmatory evidence of internal hemorrhage.

Delayed Splenic Hemorrhage

The clinical manifestations of delayed hemorrhage are commonly associated with splenic injury. In the absence of an initial episode of hemorrhagic shock, or after an initial response to infusion of whole blood, bleeding may recur at an alarming rate. Operative observations revealed that usually the bleeding is temporarily tamponaded by a perisplenic hematoma, although secondary ruptures of subcapsular hematomas may occur. The initial injury may have been trivial and may be forgotten by the time bleeding recurs.

In six of the 29 cases in which splenectomy was done in the present series, the operation was carried out after elapse of four days to four months from the time of the initial injury. In most cases there was some suspicion of splenic injury, but because of injuries to other organ systems and apparent cessation of bleeding following the administration of blood, operation was deferred. In two of the cases, splenic injury was completely unsuspected. When conservative treatment of injuries to solid viscera is attempted, as it may be sometimes because of factors contraindicating operation, cross matched blood should be kept close at hand.

Two illustrative cases follow:

CASE 1. A 22-year-old man was admitted to the hospital following an automobile accident. He was in mild shock and complained of severe pain in the chest. Upon examination a crushing injury of the left chest was noted and there was marked subcutaneous emphysema and hemothorax, evidence of pericardial effusion and fractures of two lumbar vertebrae. The patient rapidly recovered from shock. Intraabdominal injuries were suspected, but since there was rapid response to whole blood, laparotomy was deemed inadvisable in light of the associated injuries to the chest. During the next seven days large amounts of bloody fluid were drawn from the left chest by thoracentesis. On the seventh hospital day, severe abdominal pain and shock developed. Upon laparotomy, a ruptured spleen with an old perisplenic hematoma and fresh bleeding were observed.

CASE 2. A 28-year-old man came to the emergency ward in an alcoholic condition complaining of a scalp laceration and pain in the right shoulder which he said were caused by injury in a fight. X-ray films showed a right acromioclavicular separation. During the next week the patient was observed twice in the orthopedic clinic. Twelve days later he was admitted to the hospital following an episode of severe abdominal pain followed by mild shock. Upon laparotomy a huge perisplenic hematoma was observed and there was evidence of recent hemorrhage.

Gastrointestinal Tract

All segments of the gastrointestinal tract are susceptible to injury. In the present series, the incidence of gastrointestinal injuries was as follows: Stomach, one; pancreas, three; jejunum, two; ileum, five; colon, five.

The traumatic force is frequently a direct blow on the abdominal wall and knowledge of the kind and the site of the blow may be helpful in localizing the injury. Signs of peritoneal irritation usually unassociated with signs of loss of blood were commonly observed. Mesenteric bleeding may present a picture indistinguishable from that of injury to solid viscera. Delayed perforations secondary to contusion and necrosis or to mesenteric injury may occur.

Radiological evidence of a pneumoperitoneum was noted in a few cases. Pronounced leukocytosis was observed. Elevated serum amylase values may be of help in pancreatic injuries.

Diaphragm

Diaphragmatic injuries may cause obscure or dramatic symptoms. Severe blows or crushing injuries were the usual causes in the present series. Respiratory or abdominal symptoms may dominate the clinical picture. Severe thoracic or upper abdominal visceral injuries are commonly associated. In two cases in the series the injury was unsuspected and was found only on exploration in association with a ruptured spleen. X-ray films of the chest may be most helpful and barium studies are of confirmatory value if abdominal viscera are suspected to be in the chest.

Kidney and Bladder

Hematuria is commonly observed in severely injured patients. If unable to void, these patients should have catheterization immediately. Gross hematuria or other suspicion of an injured bladder calls for a contrast cystogram. A fractured pelvis was present in six of the cases in the present series in which hematuria was a symptom. Renal injuries may be localized by pain, tenderness, spasm or fullness in the offending flank. Because abdominal symptoms commonly are referred from elsewhere in such cases, careful observation to rule out other visceral injuries is necessary. Chest injuries and other visceral injuries are commonly associated. Intravenous pyelography is of value in selected cases.

TREATMENT

Prompt surgical intervention is of vital importance to prevent hemorrhage or continued peritoneal soiling. Conservative observation may be advisable in cases of suspected hemorrhage of not alarming degree when associated with severe thoracic or cerebral injuries. Decision to operate may be made only after a period of careful observation. Liberal use of whole blood is the single most important factor in lowering mortality rates. In the presence of continuing hemorrhage, operation should not be unnecessarily delayed. Good anesthesia is required and wide surgical exposure is mandatory.

2633 Pacific Avenue, Stockton 4.